Art. III.—*A New Rotifer Lacinularia striolata, with Note on L. pedunculata.*

By J. SHEPHARD.

(With Plates III., IV., V.)

[Read 13th April, 1899.]

The rotifer forming the subject of the first part of this paper has been well known in Victoria for a number of years, but has always been regarded by me as *L. pedunculata* mentioned by Dr. Hudson in the supplement to "The Rotifera" (p. 7). No figure accompanies the very brief description there given. Meeting with this form in very large numbers in a shallow pond near the Glen Eira Road, Caulfield, I was led to study it with a view to place on record some figures and further information with regard to it. While engaged in this work another similar form appeared in a cultivation from dried mud gathered at Cheltenham, but differing from the first and better known rotifer in several particulars.

Visiting Mr. Thos. Whitelegge, of the Australian Museum, Sydney, I mentioned the work I was engaged on, and he very kindly lent me his drawings of the rotifer he sent to Dr. Hudson, who named it from the spirit specimens *Lacinularia pedunculata*. From a comparison of these sketches with my own drawings and specimens I have arrived at the conclusion that the form first seen by Mr. Whitelegge, and referred to by him in the short descriptive paragraph quoted by Dr. Hudson, was certainly not the better known form, but more probably identical with the one from Cheltenham.

Lacinularia striolata, n. sp.

The animals are found in clusters varying in size from 5 mm. diameter to mere points barely visible to the naked eye. A peduncle sometimes as much as 10 to 12 mm. long anchors the colony to the stem of a submerged plant. The colour varies from a yellowish-orange to a greenish tint. As Mr. Whitelegge remarks, "a cluster might easily be mistaken for the fallen flower of an Acacia." Examination under the microscope shows the cluster to consist of individual rotifers occupying and protruding from radial perforations in a gelatinous sphere (Fig. 1); all the feet extending quite to the centre, where they are attached to a round peduncle of deep brown colour, dense looking, somewhat scarred, and expanding at its base. When subjected to any shock the animals retract themselves into the tubes, but soon extend again. The action of the ciliary wreaths of a large colony produces a very distinct current in the water, and this is the more marked from the habit the animals have of so placing themselves that all the individuals over a large portion of the colony are operating to produce a current in the same direction. In a colony of 5 mm. diameter an estimate of the number of rotifers calculated from those counted in a given area of its surface gave the total number for the whole sphere as 3681.

External Characters of Adult Female.—Individuals readily detach themselves from a colony when treated with cocaine, and can be examined in a compressorium without difficulty. Seen in dorsal aspect (Fig. 2) there is a heart shaped corona with a shallow sinus at the ventral edge, and a blunt apex at the dorsal. There is no dorsal gap, and there are two eyes rather more than halfway down placed very close to the edge on either side. The neck is moderately constricted, and the body expands to quite the width of the corona and then tapers away gradually to a long slender foot. A lateral view (Fig. 3) shows the disc of the corona to lie obliquely, its plane being advanced at its ventral edge, and making an angle of about 45° with the long axis of the animal, the ventral outline is rather arched, and the dorsal somewhat hollow but bends outwards about the termination of the stomach, and forms a prominence in which the forward pointing anus is placed. From the anus the body tapers off into the long foot. The whole length is as much as 2·6 mm., and of this only about one-fifth is occupied by the alimentary system, the remaining four-fifths being the foot which is extremely attenuated, one measured near the termination being ·004 mm. across. Two minute antennæ occur rather low down on the neck, wide apart, but on the ventral surface. The whole of the cuticle is longitudinally striated. These striations were seen in the cut edges of the cuticle in sections to be actual corrugations, and their distance apart I estimated at ·0005 mm.

External Features of Young Female (Fig. 4). These are found swimming freely and are much smaller than the adult, being only ·35 mm. in length. The body is a very gradually tapering cone, widest at the head and ending bluntly. The eyes are more conspicuous than in the adult. At the extremity of the foot there is a ciliated cup (c.c.) in communication with two large glands, of which I shall have to speak later.

Male.—Having a large number of colonies, a little watching soon discovered the male. Numerous specimens were seen hovering around the colonies and occasionally plunging between the closely packed females. They were very active and of small size, only ·17 mm. in length, or $\frac{1}{15}$th of the length of an adult female. In general outline the male (Fig. 4*a*) resembles published figures of *L. socialis.* A ciliated pit (Fig. 4*a*, c.p.) is placed on the ventral surface near the termination of the foot. The conical front has a strong tuft of setæ at its apex seated upon a nerve cell, from which a thread runs backwards to what appears a large nerve mass. The whole of the conical front is ciliated, and there is a ring of strong cilia at the base of the cone which is continued for a short distance ventrally, and is suggestive of a buccal orifice. There are two red eyes, and about $\frac{1}{3}$ of the length of the animal from the front is placed a conspicuous dorsal antenna connected with the nerve mass. Mastax and alimentary system are absent, the latter being represented by a cord running down the centre with a thickened portion about the middle. The sperm sac (Fig. 4, s.s.) is placed near the retractile penis and varies much in size, one specimen having the whole body cavity occupied by it.

Internal Anatomy of Female. Methods.—Mr. Rousselet's valuable method of killing[1] answers admirably with this form, and whole colonies with almost every individual fully extended could be obtained. It was necessary to follow up the first dose of cocaine mixture quickly with stronger doses and narcotize rapidly, as if the process was too prolonged the animals left the

[1] Jour. Queck. Micro. Club, vol. v., ser. 11, p. 5-13, No. 36, March, 1895.

colony. These fixed colonies were amenable to the paraffin method of obtaining serial sections. The stain most successful of those tried was picro-carmine. Considerable care was necessary to pass the specimens through increasing strengths of alcohol and to clear with oil of cloves. A colony thus placed in serial sections of course gave sections through individuals in every possible plane. The results obtained show that a combination of the section method with the older plan of examining the living animal is preferable to following either system exclusively.

Digestive System.—The trochus (Fig. 3, t.) and cingulum (Fig. 3, c.) form separate and complete circuits, and the groove between them is continuous round the disc. The cingulum runs backwards ventrally, forming a triangular space in which is placed the mouth (Fig. 3, m.). The mouth is slit-like, but wider at the anterior, and opens into the buccal cavity (Fig. 5, b.c.). This has a thin roof, and sections parallel with the plane of the disc show a triangular outline widest remote from the mouth, and downwards the walls rapidly converge and form a short funnel terminating in a very narrow pharynx. Nearly the whole of the buccal cavity is thickly covered with cilia. The pharynx (Figs. 5, 6, 7, p.) is close to the ventral surface. At its commencement there are two small openings (Figs. 6 and 7, s.d.) into it, one on either side, which I take to be ducts for the passage of the salivary secretion from two nucleated cells (Figs. 6, 7, 8, s.g.) situated on the floor of the buccal cavity, one on either side of the pharynx. These cells have definite borders, are spongy looking, stain faintly, and do not occupy the whole of the space surrounded by the outer wall, as there appears an unoccupied portion at the base of each. The pharynx is short, and at its lower part becomes a flattened cavity curving round the food cavity of the mastax, extending dorsally a short distance, and ventrally and posteriorly close under the cuticle of the ventral surface, where it terminates about the level of the trophi (see Fig. 5, p. and tr., Fig. 7, p.). This flattened portion communicates with the food cavity by a slit extending along its length (Fig. 7, sl., the T-shaped opening shows the part curved backwards cut across). The cilia on either side shown in Fig. 7 are from the inside of the food cavity, being cut off by the section knife. This slit will serve as a valve to regulate the entrance of food into the food cavity of the mastax. Sections show the mastax (Fig. 3, ma.) to be of considerable complexity. Seen from the dorsal in the living animal it appears as a tri-lobed mass, the mallei being imbedded in the lateral lobes, and the incus in the posterior. Sections show that the food enters a cavity of heart-shaped section seen ventrally (Figs. 7 and 8, f.c.) and this extends dorsally, becoming crescentic in section more towards the dorsal portion of the mastax (Fig. 10, f.c.). This food cavity, as for convenience I name it, has at the ventral end a membranous floor (Figs. 5, 7, 8, s.m.) which continues dorsally and joins the lateral lobes on their anterior surface. More dorsally it is seen as two membranes joining the roof of the food cavity with the lateral lobes, so that each side forms an inclined plane to direct the food particles between the cutting points of the unci. Below the unci, in that portion of the mastax dorsal of the fulcrum, there is a lower portion of the food cavity (Fig. 10, f.c.). The upper and lower portions of the food cavity are thus separated off when the unci are closed. The food cavity is strongly ciliated at the ventral part on either side of the slit (Figs. 5 and 7, f.c.); above the unci on the roof, and below on the dorsal portion excavated out of the middle of the mastax, are ridges of very thickly packed cilia (Figs. 5, 8, 9, 10, cil.m.). The opening into the œsophagus is close to the dorsal surface of the animal. The food cavity at its ventral part is separated on its sides and floor by the separating membrane (Figs. 5, 7, 8, 9, s.m.) from a cavity, portions of which are shown in Figs. 5, 6, 7, 8 and 9 (m.c.). I was unable to discover any opening into the food cavity or coelom from this mastax cavity. Fig. 10 shows that it does not extend the whole length of the mastax. The separating membrane is exceedingly delicate, and it was by the presence of food particles (Fig. 8, f.p.) always on one side that the food cavity and the mastax cavity were found to be distinct.

It will be noticed that in all the horizontal sections the mastax cavity appears as two separate portions, but I think it very probable that communication is made by means of the portion m.c (Fig. 5) and have therefore treated it as one. The trophi (Fig. 11) when dissolved out with chlorinated soda are seen to be of the malleo-ramate type, characteristic of the genus

Lacinularia and fam. *Melicertidæ.* The finer teeth are at the distal ends of the rami (Fig. 11, r.) and become gradually coarser towards the fulcrum. In a definition of this type[1] we find "unci three-toothed; rami large, with many striæ parallel to the teeth." The appearances noticed both in dissolved out trophi and in sections lead me to conclude that the striæ here spoken of are all teeth, which gradually diminish receding from the fulcrum, or, that the whole of each uncus is a sheet stretching across from the rami to the manubria in which the teeth are formed by parallel thickenings. The fulcrum is imbedded in the mastax at its ventral border (Fig. 9, ful.), so that the finer teeth are near the œsophagus. The action of the whole mastax I take to be as follows:—The food particles are admitted from the pharynx through a valvular slit into the food cavity, which forms in its ventral portion a flexible bag hanging in the mastax cavity, the cilia on either side of the slit propel the matter onwards, then the thick ridge of cilia on the roof comes into action carrying it further and at the same time forces it down between the teeth, while the cilia on the floor of the food cavity act from below in a similar way. The unci as may be seen in the living animal moving with a circular motion inwards and downwards bringing the teeth together and separating them when the motion is reversed. The food matter is thus received by the coarse teeth and passed along to the finer until it reaches the œsophagus. The use of the separating membrane appears difficult to understand, but I suggest that the mastax cavity being filled with fluid exerts a pressure upon the separating membrane and at the same time allows it to distend. This pressure forcing up the sides of the separating membrane would, together with the cilia of the roof, enable the animal to bring the food matter between the teeth. The whole apparatus appears adapted to dispose of the food matter which the trochal disc automatically pours into the buccal cavity. In the first place the pharyngeal end of the mastax may be closed, and the food particles then issue from the posterior of the mouth as is seen in the living animal; then the joint action of the separating membrane and the ciliated ridges keep the food under the

[1] The Rotifera. Hudson and Gosse, vol. i., p. 29.

action of the trophi until it is sufficiently reduced to pass easily into the œsophagus. With regard to the structure of the fleshy portion of the mastax the loops of the manubria each contain a nucleated cell (Fig. 10, nu.m.), as Vallentin found in *M. ringens.*[1] In Fig. 10 there are dotted appearances (fib.) suggestive of fibrous muscles cut across. This, Vallentin was unable to discover in the species he studied.[2] The œsophagus is long and narrow and opens into the upper portion of the stomach (Fig. 5, œ. st.) where the walls are formed of thick nucleated cells. The gastric glands lie on either side of the œsophagus, resting upon the cells of the wall of the stomach, but I was unable to find any ducts connecting them with the stomach. The walls of the stomach are thinner at its posterior portion and it there opens into the intestine (Fig. 5, int.) by a narrow passage. The intestine is thin walled and ends in a rectum directed upwards. The whole of the alimentary tract is ciliated, except the separating membrane of the food cavity of the mastax. That ciliation of the mastax occurs does not appear to have been noticed in other species investigated.[3]

Excretory System.—The lateral canals extend from the rectum to the trochal disc. Four or five pairs of vibratile tags are present. Four tags are well seen in the living animal close under the cuticle of the trochal disc (Fig. 2, v.t.). I was not able to find the "renal commissure" uniting the canals at the anterior, but succeeding in tracing in sections the termination of the canals to a point near the rectum, which they appeared to join. A contractile vacuole was not noticed, and if present must be small. The vibratile tags (Figs. 12 and 13) presented appearances entirely consistent with the views expressed previously by myself.[4] They are long and narrow in the form of a flattened cylinder; the walls are more coarsely striated than in other species, and the cap is deep. Tags were readily found in sections lying on edge, but only one doubtful view of the flat aspect was seen. It is to be expected that the flat aspect will be difficult to find in sections, as when viewed in this way in a

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1 Mag. Nat. Hist., vol. viii., ser. 6, p. 47, fig. 4.
2 Vallentin, Mag. Nat. Hist., vol. viii., ser. 6, p. 43.
3 Cam. Nat. Hist., vol. ii., p. 212.
4 Shephard, Pro. Roy. Soc. Vict., vol. xi., p. 130.

fresh specimen they are difficult to keep in view when the undulating movement ceases. It may be interesting to call attention to a certain degree of analogy existing between the vibratile tags and the tube-bearing cells (solenocytes) in the nephridia of the Polychete worms Nephthys, Glycera, and Goniada.[1] The "solenocytes" in these worms consist of thin walled tubes opening into the lumen of the nephridium and terminated by a solid mass of protoplasm from which a flagellum hangs down the tube. These tubes are in pairs in *Nephthys scolopendroides*, and are supported at the extremities by cells forming a "crook." In *Glycera convolutus* the resemblance is closer, there being no support, and the tube is "flattened from side to side," has "the appearance of being delicately fluted." In the case of the vibratile tags and solenocytes both are bathed in the coelomic fluid, and have no opening into the coelom. The only differences in the case of *Glycera* being the existence of a flagellum in place of an undulating membrane, and the base of the cell being broad instead of narrow.

Secreting Glands.—In addition to the cells opening into the pharynx and the gastric glands mentioned already, there are two large flattened bodies lying on either side of the mastax and close to the surface of the disc. These bodies are conspicuous in the living animal when they appear of a yellowish colour. Seen in section they stain very similarly to the pharyngeal glands (Fig. 6, s.g.), but no duct or communication could be found, and I feel unable to offer a suggestion as to their function. From the lower part of the intestine the whole of the foot is occupied with foot glands, one of which is shown in section (Fig. 5, m.g.). Even where the foot has become greatly attenuated they are present. That some of them secrete mucous which is discharged at the termination of the foot seems certain, but possibly they are also concerned in the formation of the gelatinous matrix of the colony, but this I propose to deal with later. These foot glands stain readily and show a distinct nucleus. In the young female they are very numerous and closely packed (Fig. 4, m.g.), rendering the whole foot almost opaque. In addition there are glands near the termination of

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[1] E. S. Goodrich on the Nephridia of the Polychaete Worms. Q.J.M.S., vol xl., p. 191. vol. xli., pp. 442, 452.

the foot (Fig. 4, s.c.g.) not found in the adult, but these will be dealt with when describing the development of a colony.

Nervous System.—Dorsal to the pharynx is a cluster of cells (Fig. 8, g.) of somewhat reticulated appearance. They coincide in position with the ganglion figured by Vallentin,[1] and although I was unable to detect the threads connecting with the marginal nerve cells of the disc, it seems probable that this represents the brain. In the Asplanchnadæ the brain can be easily seen in a specimen suitably killed and fixed with osmic acid. It there appears as a large mass giving off threads in various directions, and it is situated dorsal to the pharynx, as is the case in numerous other species of rotifers. As *L. striolata* leads a sedentary life, and the chief use of its sensory apparatus is to warn it to retract into its tube, it would appear that a simpler nervous organisation would suffice for it than for free swimming predatory animals like the *Asplanchnadæ.* Sections gave no trace of the eye spots. The ventral antennæ (Fig. 2, ant.) were well shown in sections and exhibited some detail of structure I do not remember to have seen mentioned. The section drawn (Fig. 14) shows a spherical cavity with the tuft of setæ springing from the inside and passing through a small perforation in the cuticle (c.u.): the walls of the cavity rest upon a nerve ganglion (n.g.), and from it runs a thread leading in the direction of the head. I may here state that it is difficult to trace the nerve threads, muscles, and other structures passing up the neck, as the mastax so fills the space that only a narrow ring is left where these organs are so closely packed as to be indistinguishable.

Muscular System.—Eight longitudinal muscles are seen in a transverse section of the foot (Fig. 15, mu.) and extend almost to its termination; they appear to run the whole length of the body and terminate in the trochal disc. No trace of circular muscles could be seen.

Reproductive System.—The yolk gland (Fig. 3, y.g.) is conspicuous in the adult female. Apparently there is only a single germarium situated towards the posterior end of the yolk gland (Fig. 16, v.). Ova pass down the oviduct (Fig. 5, ov.) and are extruded at an early stage and undergo development imbedded in the matrix of the colony. Ordinary and "resting eggs" (Fig.

[1] Anatomy of Certain Rotifers. Mag. Nat. Hist., ser. 6, No. 43, p. 47, pl. v., fig. 12.

17) were found, the latter possessing a hard shell with banded markings. No observations of the method of impregnation were made, but males were seen repeatedly plunging into the colony between the females and disappearing from view. Spermatozoa occur in the sperm sac, coiled up in a flask-shaped capsule (Fig. 18), which is ciliated on one side, and on being forced into the water by compression rapidly disintegrates, and the spermatozoon (Fig. 19) is set free. The length of a spermatozoon is about ·045 mm.

Structure of Peduncle and Matrix of Colony.—A transverse section across the peduncle and along the equator of the colony, shows the peduncle composed of a dense brownish mass, with irregularly shaped cavities in it (Fig. 20). Radiating from it and given off from projecting angles are the walls of tubes (Fig. 20, w.t., and Fig. 20, a.) which contain the individual rotifer. For a short distance these tubes are thin and rigid, and then gradually pass into a soft gelatinous substance. The matrix may be regarded as a ball of mucous perforated with radiating conical pits, hardened towards the centre. Each pit contains a rotifer with its foot attached to the bottom (Fig. 20, ter.), which is a short distance from the peduncle, and this forms a septum perforated in the middle to permit the passage of mucous or cement through it. Fig. 20 shows this where *ter.* is the bottom of the pit and the point where the foot terminates, and *muc.* the mucous thread exuding from it and connecting the animals with the peduncle. Evidently the peduncle is the product of the combined exudations of the whole colony and grows in length as the individuals mature, and this is corroborated by the fact that the younger colonies possess a shorter peduncle. The cavities are due to stresses set up by the rates of deposition differing in certain portions of the colony, the cement being plastic near to each animal. As the mucous or foot glands (Fig. 3, m.g.) extend over four-fifths of the entire length of the animal, the formation of the softer and more bulky part of the matrix towards the periphery may be due to secretion from the surface, as is the case in the Floscules, and even in some free swimming forms as the genus *Copeus*. There are reasons for regarding the whole mass as a joint product and not the adherent tubes of the individuals, as will be seen later.

Life History.—Sections across the colony show ova undergoing development in numbers considerably larger than the parent animals. On the young hatching they swim away, but with the foot bent so that their track is an irregularly curved one. This distinctly favours their aggregation into groups. It was very noticeable that all stages of growth from the young female (Fig. 4) to the adult (Fig. 3) were to be seen in different colonies, each colony being composed of individuals of the same stage of growth and therefore age. With this fact in mind, and observing the young females in swarms, I was led to watch their movements. A swarm was isolated and watched. In the first stage they formed a writhing mass adjacent to some solid particle in the water, some individuals placing themselves in the position they would assume in a fully formed colony (Fig. 21, a.), and breaking away would wheel round and plunge into the mass again. These manœuvres were somewhat puzzling, but I ultimately satisfied myself that at this stage the animals pour out a transparent mucous and congregate in its midst, and the position of animals as at (a., Fig. 21) is due to being attached to it by the foot, while the ciliary action of the corona tends to draw them from it, and their leaving the colony is due to the attachment giving way. In three hours the swarm had so arranged itself that the individuals were more radially placed, and about their now adjacent feet was a mass of granular particles (Fig. 22, c.g.) connecting them with the particle of vegetable matter (a.). Mounts made later clearly showed this cement to issue from the terminal pore. Next day a distinct peduncle was formed (Fig. 23). The colony was watched for three days, and during this period the growth of the peduncle went on. Being in a small quantity of water its movements became less vigorous, and it was killed and mounted. Examination showed it to be of essentially the same structure as an adult colony. The first deposition of mucous in Stage 1 (Fig. 21) would appear to arise from the mucous glands (Fig. 4, m.g.), either exuding from the surface or by way of the terminal pore, and the denser cement laid down in Stage 2 (Fig. 22) from the special cement glands (Fig. 4, s.c.g.), for these two glands are filled with granular material which does not diminish until Stage 2 is reached, when it soon becomes exhausted. The contents of these special cement glands are derived from the nutritive yolk matter, as they can be seen developed in the ova in an advanced stage. When once emptied these glands do not fill again, but disappear. It seems highly probable that they are a special development providing the animals with a supply of material to lay the foundation of of the peduncle before the animals can obtain food to manufacture into mucous and cement. There must be some vestige of these glands remain, for the colony produces cement material throughout life. With growth the foot becomes greatly elongated and attenuated, and the mucous glands exist along its whole length, becoming larger as the foot widens. Examination of many adult individuals failed to discover any trace of these special cement glands. Possibly these glands may be receptacles storing up the materials until required and disappearing when no longer needed, the cement then being poured out as it is produced. It is thus seen that colonies are not increased in numbers by the addition of descendants of the founders, but are the result of a swarming process. No case of young and adult animals co-existing in a colony was met with. *L. reticulata*[1] I have observed does increase by the addition of the young rotifers, and colonies of this form have been met with 20 to 25 mm. diameter. Also free swimming colonies of *L. elliptica*,[2] where the young are found at one pole of the axis, and the adults at the other. One interesting point remains to be determined, viz., the formation of a colony from the resting eggs. When once originated the production of numerous colonies will result from a plentiful food supply. Thus on the occasion of gathering the animals used in this work the water was thick with a minute form, probably a flagellate protozoon, on which the animals fed. In one case where the animals were numerous, they were found to appear, culminate, and disappear in about six weeks.

The specific characters of this form may be summarised as follows:—Colonies spherical when adult; with peduncle; matrix gelatinous. Female: with foot four-fifths of total length; corona heart-shaped, as wide as body, and moderately inclined to trunk; no dorsal gap; two small ventral antennæ, wide apart; two eyes. Young female: with ciliated cup at termination of foot;

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1 Anderson and Shephard, Proc. Roy. Soc. Vict., vol. iv., N.S., 1892, p. 73.

2 J. Shephard, Vict. Naturalist, vol. xv., p. 73.

two large cement glands or receptacles. Male: without mastax and alimentary system; two eyes; dorsal antenna; ciliated cup ventrally near posterior.

Dimensions.—Colony, 5 mm. diameter. Peduncle, 10 to 12 mm. long. Adult female, 2·6 mm. long; corona, ·18 mm. wide. Young female, ·35 mm. long. Male, ·17 mm. long. Resting egg, ·145 mm. x ·097 mm.

Habitat.—Brighton, Caulfield. Lagoons along the valley of the Yarra.

Lacinularia pedunculata.

I have only met with two colonies of this species. These remarks and figures are given so that this species may be definitely identified, and in order to make clear the specific differences between it and the form previously dealt with. As in *L. striolata* there is a spherical colony of rotifers attached to a long slender peduncle. The smaller of the two colonies was evidently more developed as the individuals, twenty-two in number, were larger, and ova were numerous. The females composing the colony were about 1 mm. in length (Figs. 24, 25); the corona heart shaped, and three times the width of the body; the plane of the disc being inclined until nearly parallel to the axis of the body. The dorsal gap is absent. The trochus and cingulum are separated by a wide groove, narrowing at the dorsal portion of the corona. Two obvious ventral antennæ occur, and there are two eyes placed about half-way down the corona and close to the trochus. The mouth has two ridges running forward on either side, which have the power of coming together and thus close the mouth. A yellowish mass above the mastax is very conspicuous. The body for some distance below the neck is ridged transversely and tapers away to a long narrow foot. In general outline it resembles *L. socialis* much more than *L. striolata*. The internal atanomy presents no features obviously differing from the usual type of the genus. There seems to be no doubt as to the distinctness of this form from the one previously described as *L. striolata*. The much greater width of the corona, and the different arrangement of the trochus and cingulum as well as the peculiar contractility of the mouth mark it off distinctly. Mr.

Whitelegge[1] is quoted as describing the corona as "intermediate in shape between *L. socialis* and *Megalatrocha alboflavicans.*" This fairly describes the specimens I have seen, and after examining his sketches, I have no doubt that mine are of the same species as those sent to Dr. Hudson, and alluded to in the description quoted. Owing to the few specimens obtained, drawings of the mastax and observations of the internal structure by the section method could not be attempted. The form would doubtless yield interesting matter should an opportunity occur to examine it further.

Specific characters. Colony spherical, with gelatinous matrix and peduncule. Female with corona three times as wide as body; trochus and cingulum wide apart; mouth with contractile processes running forward. Two obvious ventral antennæ. Two eyes.

Dimensions.—Length of female, 1 mm. Width of body, ·08 mm. Width of corona, ·24 mm.

Habitat.—Sydney (Mr. Whitelegge). Cultivation from dried mud collected at Cheltenham.

In concluding this paper, I have to thank Professor Spencer, for advice and willing help in procuring books of reference for me.

LIST OF REFERENCE LETTERS.

s.s.—Sperm sac.
c.p.—Ciliated pit.
c.c.—Ciliated cup.
m.—Mouth.
b.c.—Buccal cavity.
p.—Pharynx.
s.d.—Salivary duct.
s.g.—Salivary gland.
f.c.—Food cavity.
sl.—Slit communicating between pharynx and food cavity.
ma.—Mastax.
m.c.—Mastax cavity.
c.—Cingulum = Secondary ciliary wreath.
cil.m.—Cilia of mastax.
s.m.—Separating membrane.
n.t.—Nerve thread.
n.g.—Nerve ganglion.
mu.—Muscle.
y.g.—Yolk gland.
v.—Vitellarium.
o.—Ova.
ov.—Oviduct.
f.—Foot.
ca.—Cavities.
h.m.—Hardened mucous.

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1 The Rotifera, Hudson and Gosse, Supplement, p. 7.

f.p.—Food particles.
nu.m.—Nuclei of mastax.
fib.—Muscle fibres cut across.
œ.—Œsophagus.
st.—Stomach.
int.—Intestine.
v.t.—Vibratile tags.
m.g.—Mucous gland.
s.c.g.—Special cement gland.
g.—Ganglion or brain.
ant.—Antenna.
t.—Trochus = Principal ciliary wreath.
muc.—Mucous.
ter.—Termination of foot.
c.t.—Cut edge of tube.
w.t.—Wall of tube.
c.g.—Cement granules.
man.—Manubrium.
ful.—Fulcrum.
l.c.—Lateral canal.
cu.—Cuticle.
nu.—Nucleus.
tr.—Trophi.

EXPLANATION OF FIGURES ON PLATES III., IV., AND V.

L. striolata.

Fig. 1. Adult colony. × 7.

,, 2. Adult female. Dorsal aspect. Drawn from living and preserved specimens. × 66.

,, 3. Adult female. Lateral view. From living animals. × 133.

,, 4. Young female. Dorsal view. From living animals. × 285.

,, 4*a*. Male. Lateral view. From living animals. × 317.

,, 5. Longitudinal vertical section of adult female. Oc. mag. 5. $\frac{1}{5}$ and $\frac{1}{10}$ immer. × 200.

,, 6, 7, 8, 9, 10. Successive longitudinal, horizontal sections of anterior. Six commencing immediately under the ventral surface. Viewed from the ventral. Oc. mag. 5. $\frac{1}{5}$ and $\frac{1}{10}$. o.im. × about 300.

,, 11. Trophi of young female. Drawn from a specimen dissolved out with chlorinated soda. Oc. mag. 5. $\frac{1}{10}$ immer. Dimensions: Breadth, ·05 mm.; Depth, ·02 mm.

,, 12 and 13. Vibratile tag. Flat aspect and edge view. Drawn from living animal. Dimensions: Length, ·012 mm.; Breadth, ·0025 mm. Oc. mag. 8. $\frac{1}{10}$ immer.

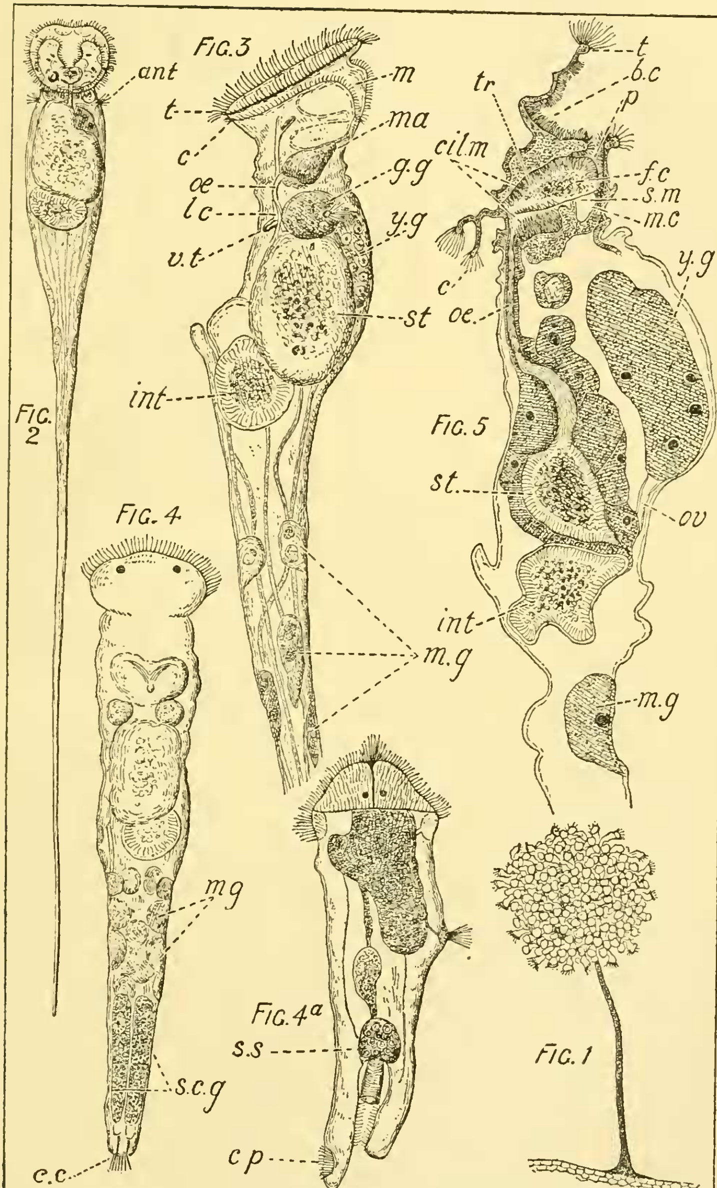

FIG. 1
FIG. 2
ant
FIG. 3
t
c
m
ma
oe
l c
v. t
g. g
y. g
st
int
m. g
FIG. 4
mg
s.c.g
c.c
FIG. 4a
s.s
c p
FIG. 5
t
b.c
tr
p
cil.m
f.c
s.m
m.c
c
oe.
y.g
st.
ov
int
m.g